VALUE ADDING AND SUPPLY CHAIN DEVELOPMENT FOR FISHERIES AND AQUACULTURE PRODUCTS IN FIJI, SAMOA AND TONGA

Tilapia Products Sensory Evaluation

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Value adding and supply chain development for fisheries and aquaculture products in Fiji, Samoa and Tonga: Tilapia products sensory evaluation in Samoa

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Table of Contents

List of Figures and Table

List of Appendix

1.0 EXECUTIVE SUMMARY

Nile tilapia (*Oreochromis niloticus*) is an introduced low-value freshwater fish in the Pacific which can easily adapt to a wide variety of breeding environments. However, this fresh water fish has limited scope for consumption in the fresh form in Pacific Island Countries like Fiji, Samoa and Tonga. Tilapia could be used to alleviate food security issues in light of the increasing fishing pressure and climate change threats.

This study attempts to explore possibilities of better utilization of tilapia by the development of four value-added products. These included smoked-fish brined in 30ppt salt solution, smoked-fish cured in a mixture of 30ppt salt and 18ppt sugar solution, surimi and fish paste. These were then evaluated through a consumer preference test. Prior to the development of the four value-added products, flavour and texture profiling were conducted on smoked tilapia brined in four different salt concentrations; 90ppt, 70ppt, 50ppt, 30ppt and a mixture of 30ppt salt and 60% (18ppt, w/w) sugar solution. Fresh untreated tilapia and non-brined-smoked tilapia were used as controls. All tilapia samples were steamed for 20-25 minutes and cooled prior to sensory evaluation. Sensory terminologies and a scoring system for fresh untreated non-brined smoked and brined smoked tilapia containing different salt concentrations were developed by trained panellists. Results of sensory profiling revealed that there was no difference between smoked fish brined in 90ppt and 70ppt and that these were both too salty to taste. The smoked tilapia brined in 30ppt salt solution and the cured sample in a mixture of sugar and salt solution had firmer texture and acceptable salt levels, thus were selected for further development for consumer preference test along with surimi and fish paste.

The consumer preference test for these four value-added tilapia products was conducted at the fish market in Apia, Samoa where a total of 65 people participated. The descriptive analysis of the results showed that fish paste was most preferred by consumers, followed by brined-smoked, surimi and then cured-smoked. However, statistic analysis by one-way ANOVA (Completely Randomized Design) revealed no significant differences in the consumer preference for these value-added products ($P \geq 0.05$). Further analysis showed that only 9% of the participants had some previous experience eating tilapia, 46% either strongly agreed or agreed that 'Fresh farmed Nile tilapia tasted the same as marine fish while 20% either disagreed or strongly disagreed. Factors contributing to purchasing tilapia for consumption appeared to have higher variations in sensory attributes. The most important sensory attributes in descending order were, 19% taste, 16% texture, 15% appearance, 14% flavour, 13% odour, and 11% size. In addition, 12% preferred whole fish compared to fillets when buying. This study is important in understanding the ideal tilapia products for the Samoan market which may then guide farmers in growing appropriate

sized tilapia. Tilapia has great potential in entering the commercial market which eventually contributes to food security in the Pacific region.

2.0 Introduction

The purpose of this activity was to promote tilapia value-added products through a public sensory evaluation in Samoa. Prior to the sensory evaluation, face-to-face interviews were conducted for background information. The four value-added products were: brined-smoked, cured-smoked, surimi and pate or fish paste developed from Nile tilapia, *Oreochromis niloticus*. Generally, the sensory attributes investigated for the tilapia products included odor, flavor, texture, taste, size and preference for either whole fish or fillets. A total of 65 people from a range of socio-economic consumer segments and food service industries, including restaurants, hotels, supermarkets, municipal markets, fish industries and tilapia farmers participated.

The specific objectives were as follows;

1. Identify consumers' knowledge and consumption behaviour of fish, tilapia and tilapia products;
2. Assess consumers' perception of tilapia over marine fish, identify factors influencing tilapia products buying behaviour and the important tilapia products sensory attributes required by consumers;
3. Analyze how and to what extent these sensory characteristics influence consumers' choices;
4. Determine which of the four tilapia products was the most preferred.

Results are divided into three sections as follows:

- Section A: shows the demographic characteristics of participants that participated in the tilapia sensory test in Apia, Samoa;
- Section B: focuses on fish consumption characteristics of participants;
- Section C: presents sensory attribute preferences of Nile tilapia products by participants and the ranking of the four products.
- Note that Sections A and B were conducted prior to the sensory evaluation proper in Section C.

3.0 Background

In the last two decades, aquaculture has contributed to the increasing share of international trade of fisheries commodities with tilapia being one of the contributing species (FAO, 2012). Tilapia is a generic term used for a commercially important food fish belonging to the family Cichlidae (Chapman, 2012). Tilapia originated from Africa and introductions were subsequently made to other countries including the Pacific in the 1950s for farming purposes (Nandlal & Pickering, 2004). Several species belonging to the genus's *Oreochromis* and *Tilapia* are cultured and growth is best at temperatures between 25°C and 30°C, making it suitable for culture in tropical environments such as in the Pacific Island countries (Muir & Roberts 1988). Tilapia is one of a handful of species available that meets the requirement for successful low-cost farming: it is hardy, easy to breed and grow, and versatile in what it can eat, requiring very little or no use of high technology for farming (Nandlal & Pickering, 2004). Tilapia is a white fish, and thereby represents a good substitute for other marine white fish. While a great deal is known of the socio-economic aspects of tilapia in the Pacific region, little has been done on value-addition, processing and product enhancement.

In some Pacific islands, particularly those with vast freshwater systems such as Fiji, tilapia is sold live in the local markets and the demand is extensive. However, many consumers do not prefer tilapia compared to that of marine fish because of its bland characteristic taste. The taste needs to be enhanced and its shelf-life improved and extended, if tilapia is to be commercialised to meet market demand. There is a need to develop additional sales outlets for live tilapia, and product development to diversify the ways in which tilapia could be sold. The important issue that needs to be addressed includes shelf-life extension while maintaining the nutritional quality of the product. Therefore, this study focuses on the investigation of possible product development and enhancement methods that could be used at the community level and have the potential for commercialisation. If successful post-harvest strategies for tilapia are developed, new markets could be established. This may contribute to income generation, improve food-security and livelihood enhancement. Furthermore, product development of farmed fish may improve the contribution of aquaculture to the Pacific Island countries' Gross Domestic Product (GDP).

It is interesting to note that wholesale buyers for large volumes of tilapia in the Pacific are non-existent, thus farmers are forced to sell live fish in municipal and rural markets. This poses logistical problems in keeping fish alive, and these types of sales points are easily saturated. Furthermore, marketing of tilapia presents another problem because of its characteristic muddy taste. This is more so in the small Pacific island countries as they are surrounded by and dependant on the sea for their major protein source. As an alternative to live sales, the

production and promotion of value-added tilapia could be an attractive commodity (Cortesi *et al*, 2009). Fritzsimmons (2006) suggests that consumption of tilapia can be increased by more consumer recognition, improved quality, and variety of product forms, better marketing and overall increased demand for fish products. The focus of this study was to value-add tilapia and identify the most preferred products through a consumer preference test in Samoa.

4.0 Research Methodology

This study attempts to explore possibilities of better utilization of tilapia by the development of four value-added products. These included smoked tilapia brined in 30ppt salt solution, smoked tilapia cured in a mixture of 30ppt salt and 18ppt sugar solution, surimi and fish paste which were evaluated by a consumer preference test.

Prior to the development of these four value-added products, flavour and texture profiling were conducted on smoked-tilapia brined in four different salt concentrations; 90ppt, 70ppt, 50ppt and 30ppt with an additional mixture of 30ppt salt and 18ppt sugar solution which were developed using fresh untreated tilapia. Tilapia that was non-brined smoked and fresh untreated was used as controls. All tilapia were steamed for 20-25minutes and cooled prior to sensory evaluations. Sensory terminologies and a scoring system for all tilapia were developed by trained panelists.

Prior to the actual sensory evaluation session, questionnaires and ballot papers were plotted and tested by the Samoan Fisheries Officers (who assisted with the interviews) to ensure that questions were clear (Appendix 1). Each participant took about one hour to complete both the interview and ballot paper. Consumer panelists were invited through the media and personal invitations. The sensory evaluation assessed the major sensory attributes that contributed to the purchase of tilapia and tilapia related products by the consumers.

5.0 Results

5.1 Section A: Demographic Data

This section focuses on the demographic characteristics of the participants that took part in the tilapia sensory test. A total of 65 people participated in the tilapia sensory evaluation conducted in Samoa in July, 2011. Out of the 65 participants, 49 (75.5%) were males and 16 (24.5%) were females and of which 1 (1.5%) respondent was between 1 to 20 years old, 14 (21.5%) were

between 21 to 30 years old, 14 (21.5%) were between 31 to 40 years old, 9 (13.8%) were between 41 to 50 years old, 12 (18.5%) were between 51-60 years old and 10 (15.4%) were 61 years and above. There was no response from 5 participants (Figure 1).

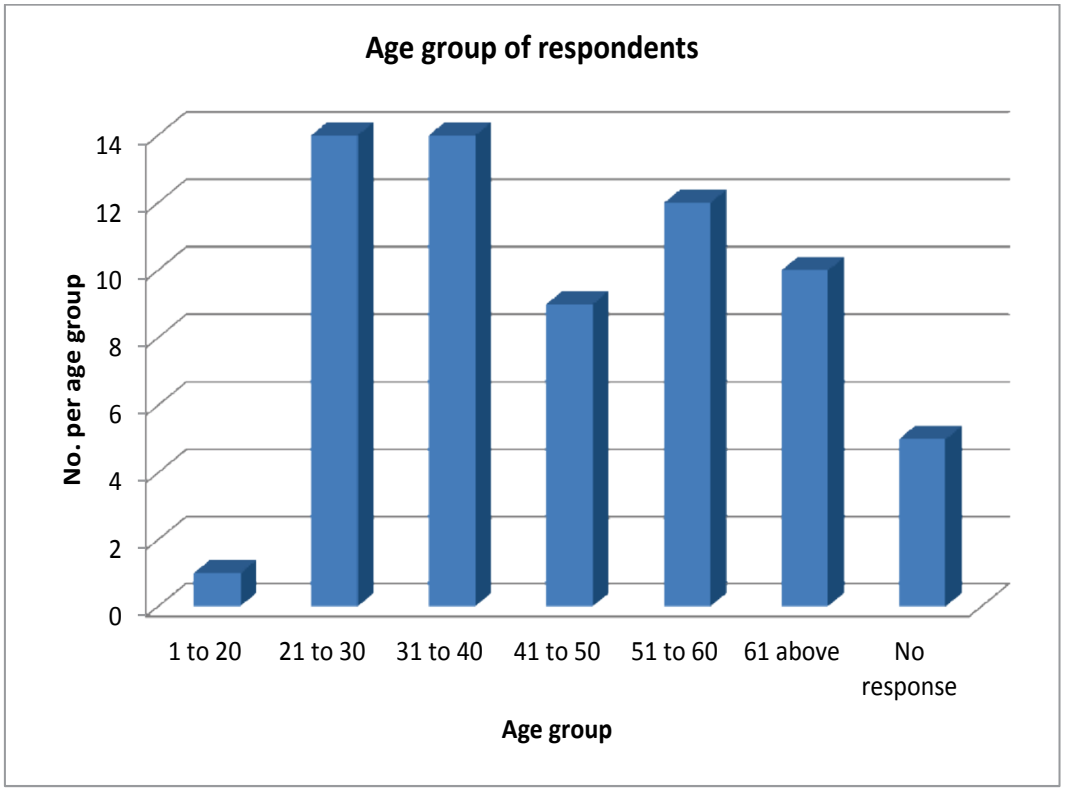

Figure 1: Different age groups of respondents that took part in the sensory evaluation.

The ethnic background of the participants was also noted. Out of the 65 participants, majority were ethnic Samoan (73.8%), while Others and Mixed were 9.2% each, and European 7.7% (Table 1). Sixty out of the 65 participants were from Upolu, 1 participant each from the respective islands of Savaii, Manono, Apolima and 2 were from elsewhere.

Table 1: Ethnic Background of the participants

Ethnic Background	No. of participants
Ethnic Samoa	48
European	5
Mixed	6
Chinese	0
Other	6
Total	*65*

The level of formal education (primary, secondary and tertiary inclusive) was also assessed. Out of the 65 participants, 33 had between 11-20 years of formal education and 6 had between 21-30 years of formal education (Figure 2).

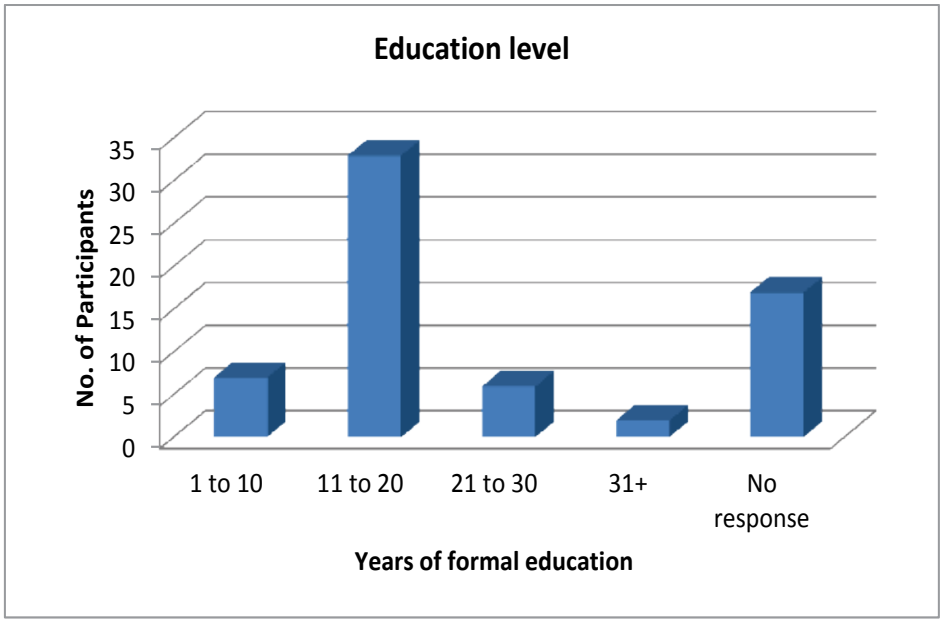

Figure 2: Frequency of participants in the different level of formal education.

5.2 Section B: Consumption Characteristics of Fish Consumers in General

These sections focussed on the participants past and current behaviour of purchasing and consuming fish.

Consumption Behaviour

Survey results of the monthly frequency consumption of fish (Figure 3) indicated that 51.5% of the participants consumed fish approximately eight times a month, 24.6% consumed fish four times a month and 21.5% consumed fish less than three times in a month.

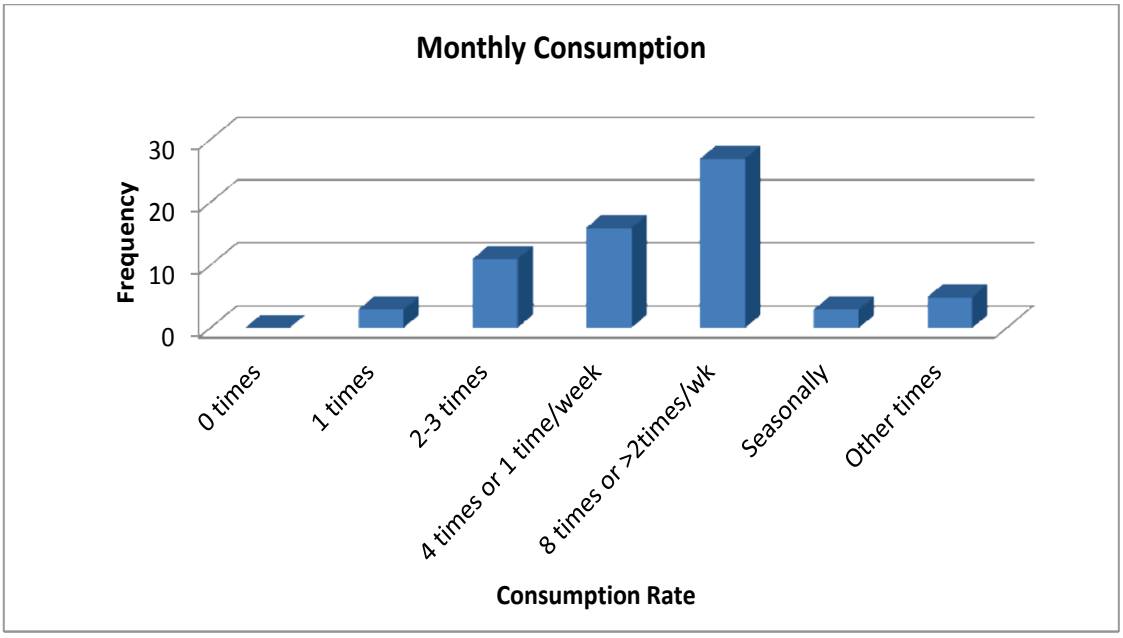

Figure 3: Frequency of response on how many times fish is consumed per month.

Participants were also asked where (home, restaurant, gathering) they usually consumed fish and responses were: 67.7% consumed fish at home and 27.7% consumed both at home and in restaurants. Interestingly none of the respondents chose party/gatherings (Figure 4). Types of fish normally consumed were mainly reef fish and tuna. Tilapia did not seem to be a commonly consumed fish (Figure 5).

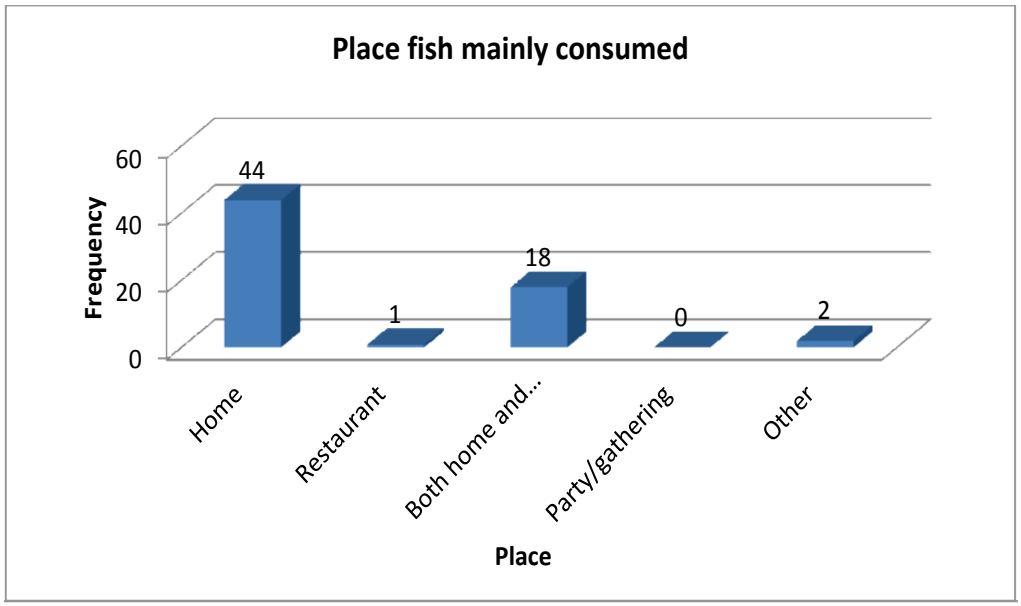

Figure 4: Frequency of response on where fish is normally consumed.

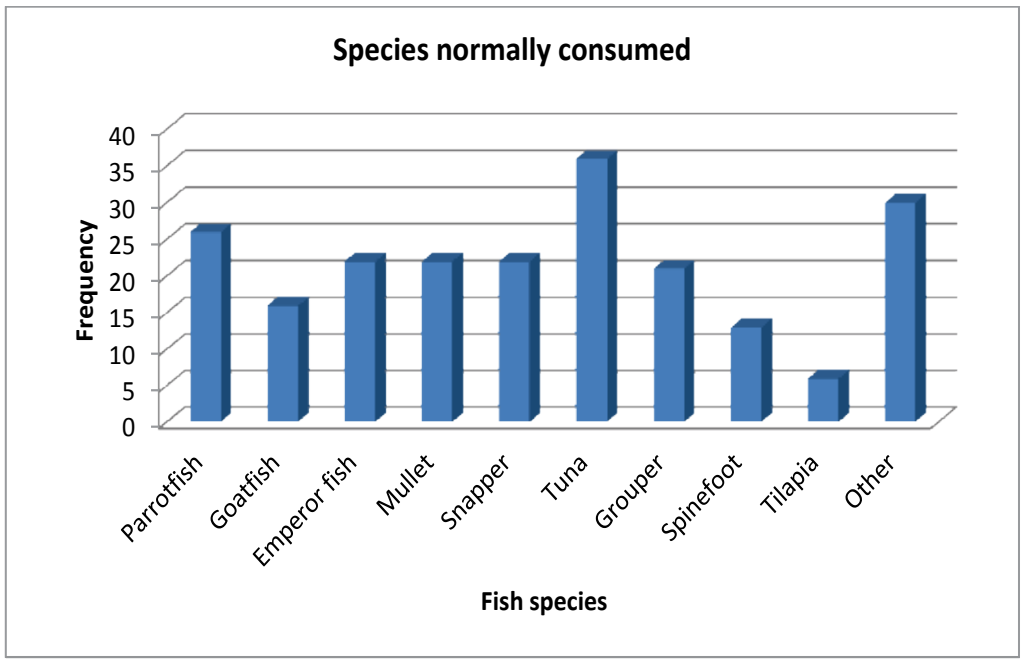

Figure 5: Ranking of species normally consumed.
(Note: participants asked to choose more than one species)

Attributes for Buying Fish

Respondents were asked to identify attributes they chose when buying fish. Results showed that freshness was the most important attribute followed by appearance, taste and flavour. Species and size of fish were the least important attributes when choosing and buying fish in the market (Figure 6, Appendix 1).

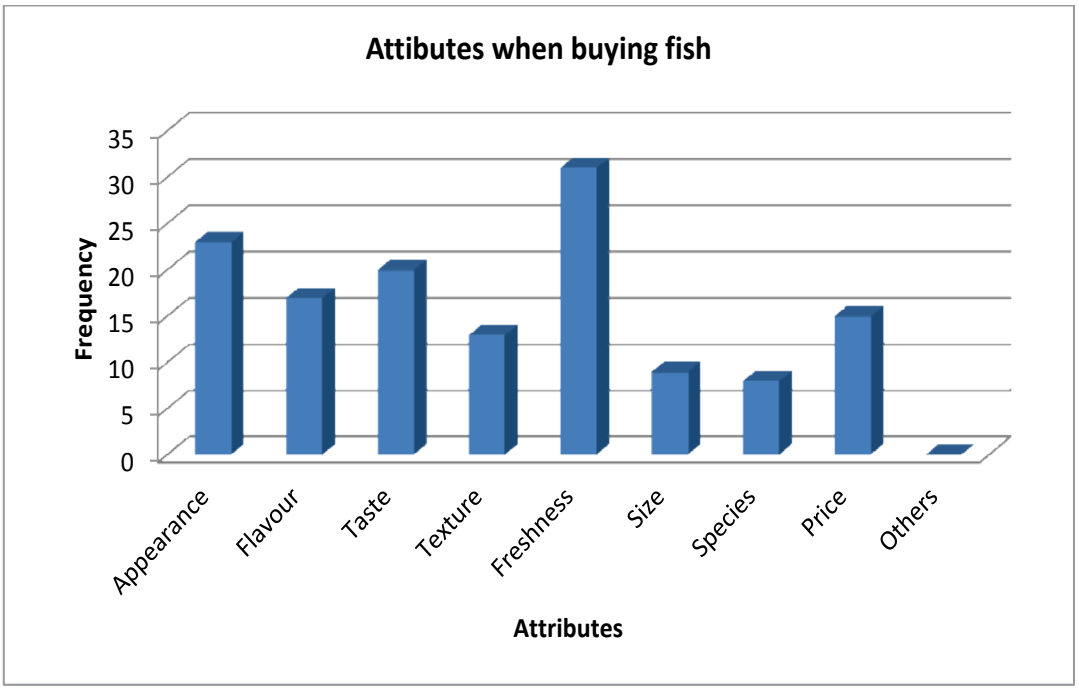

Figure 6: Important attributes people chose when buying fish from the market.
(Note: participants chose more than one attribute)

Tilapia Versus Marine Fish

Respondents' perception on the taste of fresh farmed tilapia verses marine fish was also considered. While 46.2% strongly agreed or agreed on the statement that tilapia tasted like marine fish, 30.7% strongly disagreed or disagreed on the same statement. Figure 7 shows the overall perception of participants to the statement that, "tilapia tastes the same as marine fish".

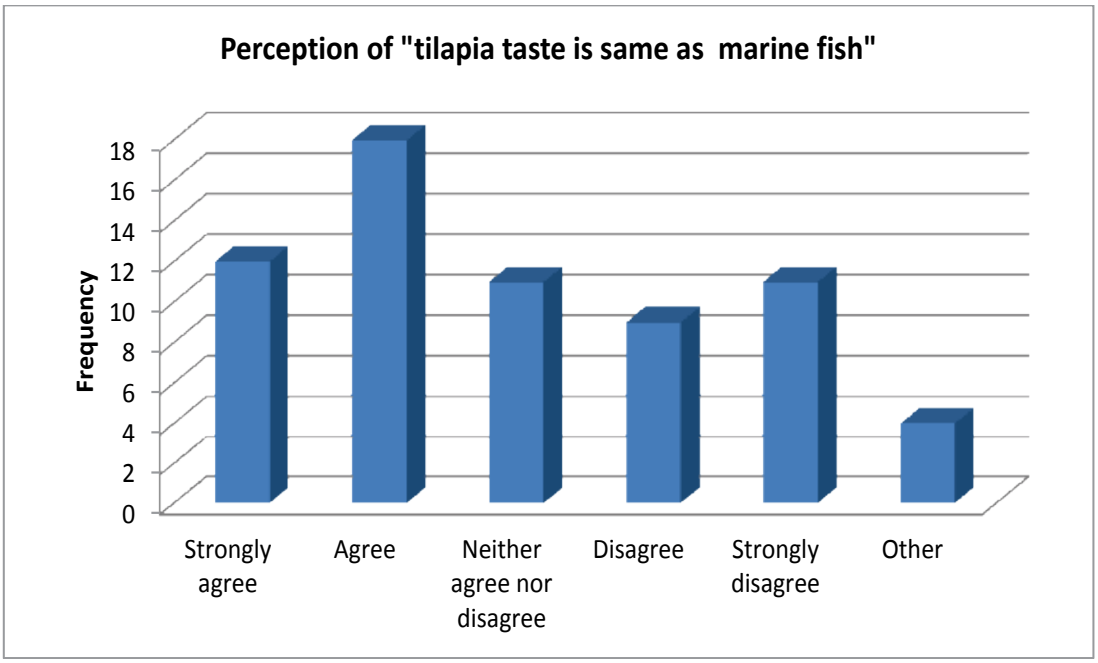

Figure 7: Perception of tilapia and marine fish taste.

Pre-treatment Preference and Sensory Attributes for Tilapia

Following the questions on fish consumption behaviour in general, specific preference of fresh and treated tilapia were also studied. Prior to tasting the tilapia products, participants were asked to rank their pre-treatment preference (Figure 8). Majority preferred to buy live tilapia followed by fresh untreated tilapia.

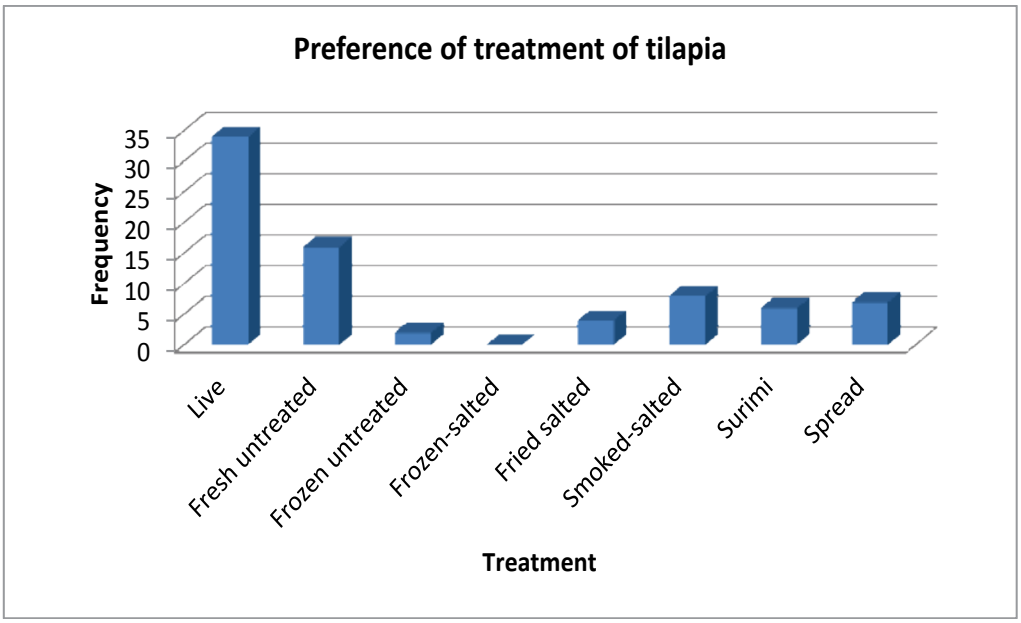

Figure 8: Preference frequency of different treatment of tilapia
(Note: participants chose more than one pre-treatment)

Participant's perception on what sensory attributes are important in a "tasty tilapia" is shown in Figure 9. Majority of the respondents chose taste as an important attribute, followed by texture and appearance. While size was the least important, some respondents ranked fillets as an important attribute (Appendix 3).

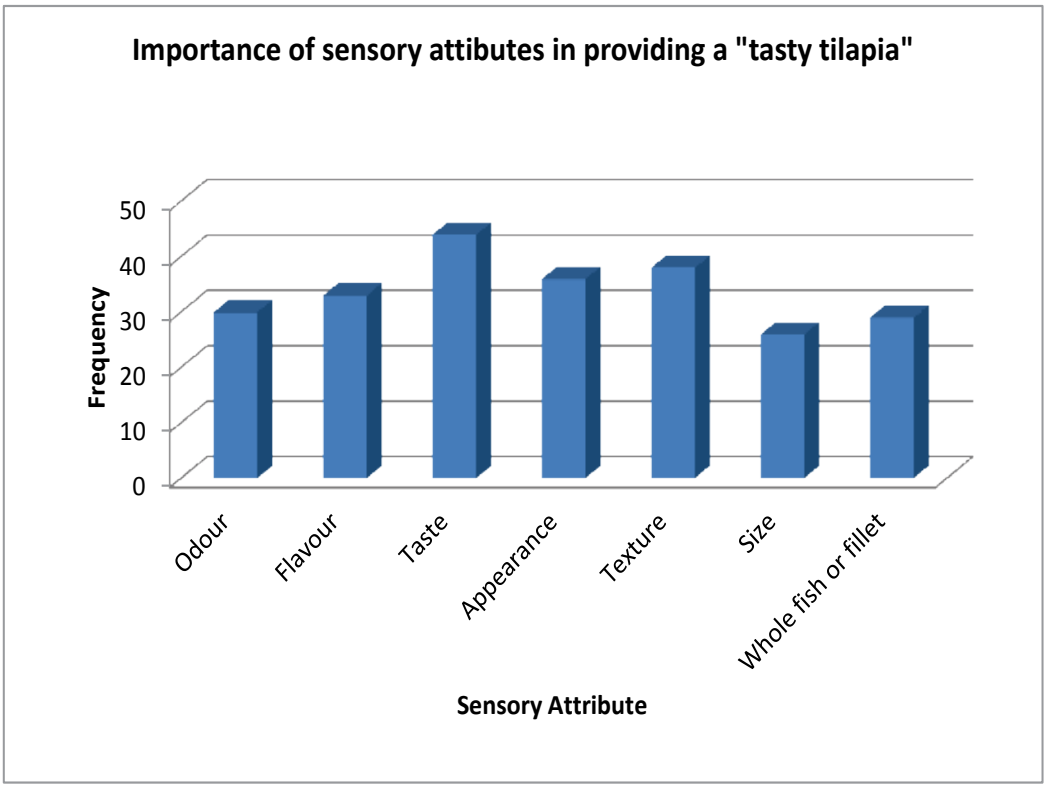

Figure 9: Ranking of sensory attributes when providing a tasty tilapia.
(Note: Participants selected more than one attribute)

5.3 Section C: Preference of Nile tilapia products

The sensory evaluation data was categorized into six different attributes: Odour, Flavor, Taste, Appearance, Texture and Size. Results for sensory attribute preference are summarized in Figure 10.

Results of the preference (%) of sensory attributes for each tilapia product showed that for brined smoked tilapia, odour was the most important attribute with its percentage preference being 21.4%, followed by flavour (19%) and texture (18.3%). Whereas cured smoked tilapia had a close preference percentage for taste (20%), odour and texture (19.1%). Odour (22.3%) and taste (21.6%) were the most preferred attributes for surimi, with the flavour, appearance and texture ranging between 18.7-19.4%. For pate, the most important attribute was odour (21.1%) followed by taste (20.5%) while flavour, appearance and texture ranged between 19.3-19.9%.

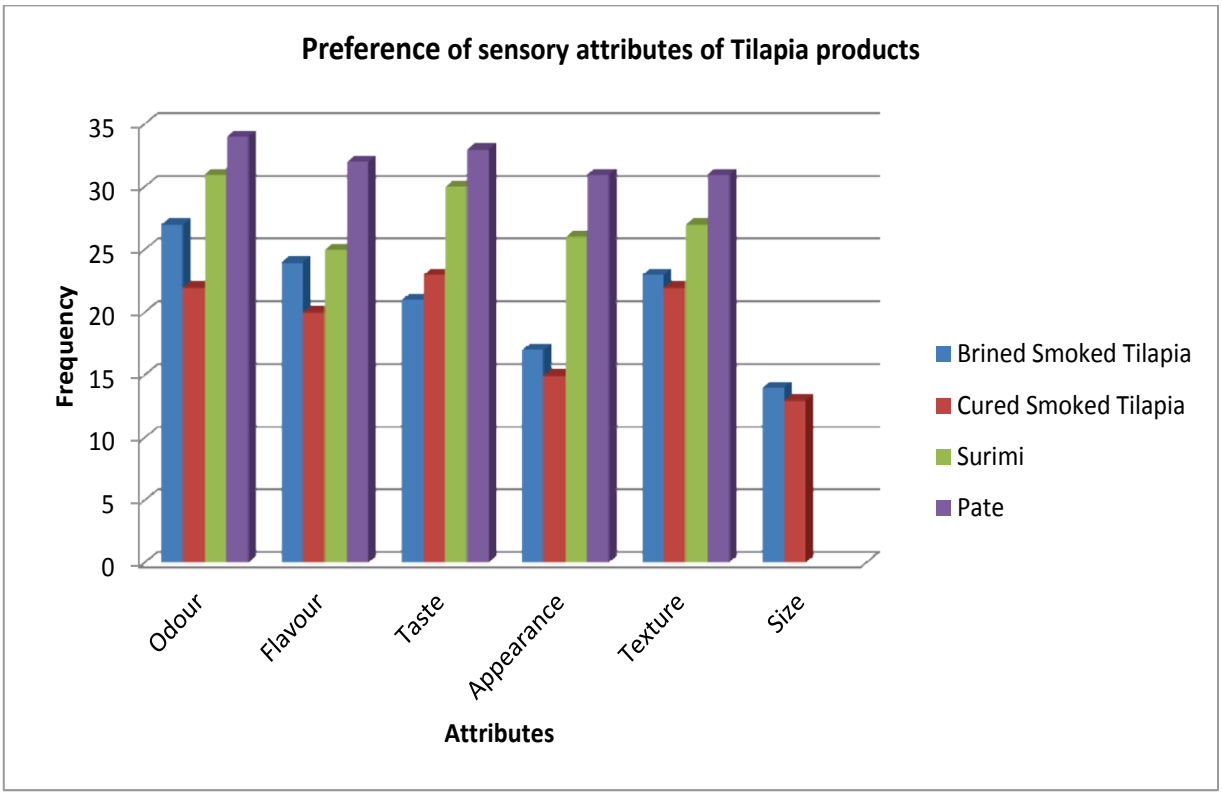

Figure 10: Sensory attribute preference for the four different tilapia products.
(Note: Participants selected more than one attribute)

A detailed comparison of each attribute: - odour, flavour, taste, appearance, texture and size between products was done, and preference was ranked using a 9-hedonic scale (Figure 11).

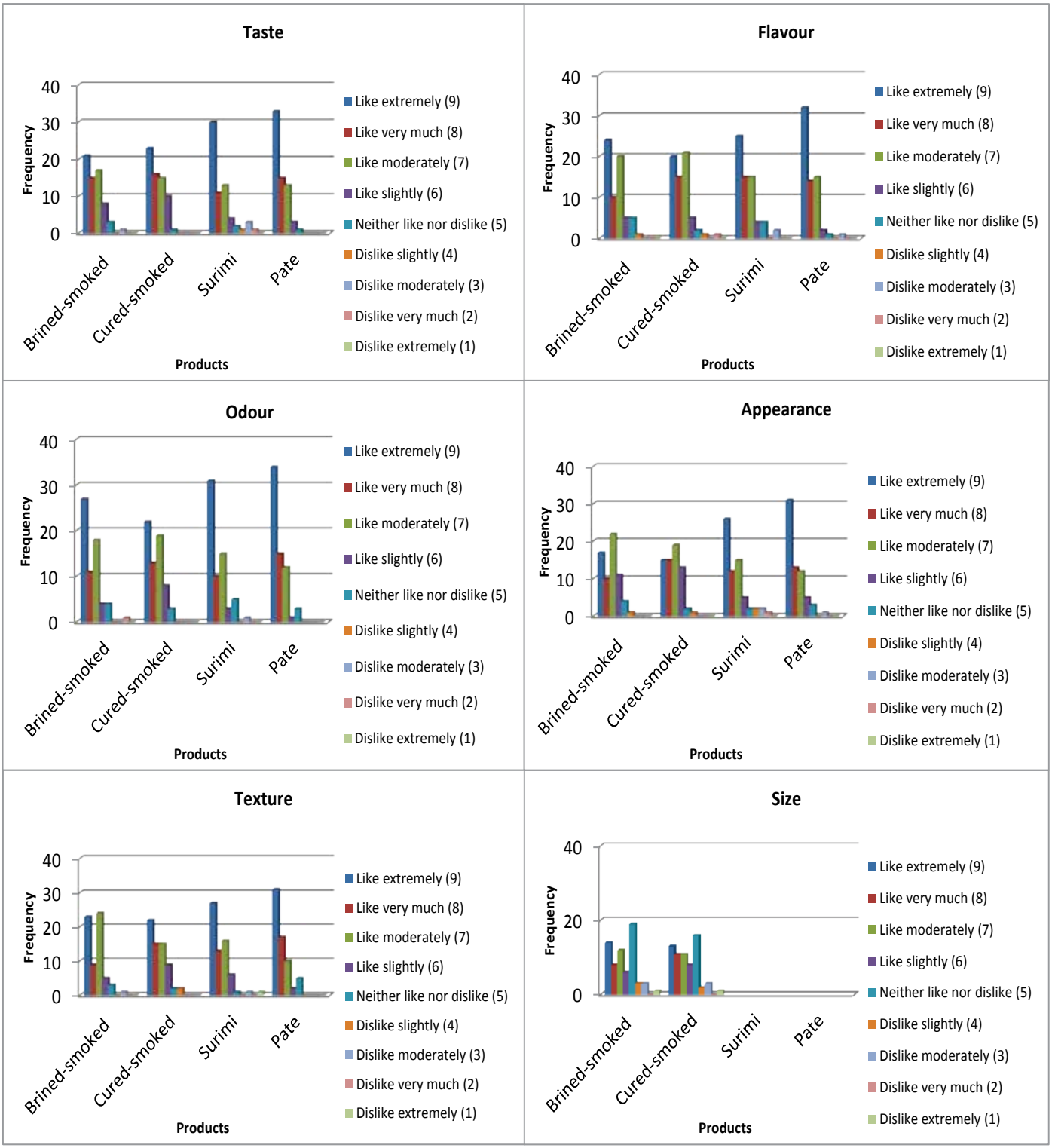

Figure 11: Comparison of different sensory attributes of the four Tilapia products on the 9-hedonic scale.

Overall the most preferred tilapia products were pate, followed by brine-smoked, surimi and cured-smoked, however the difference in preference was not statistically significant (Figure 12).

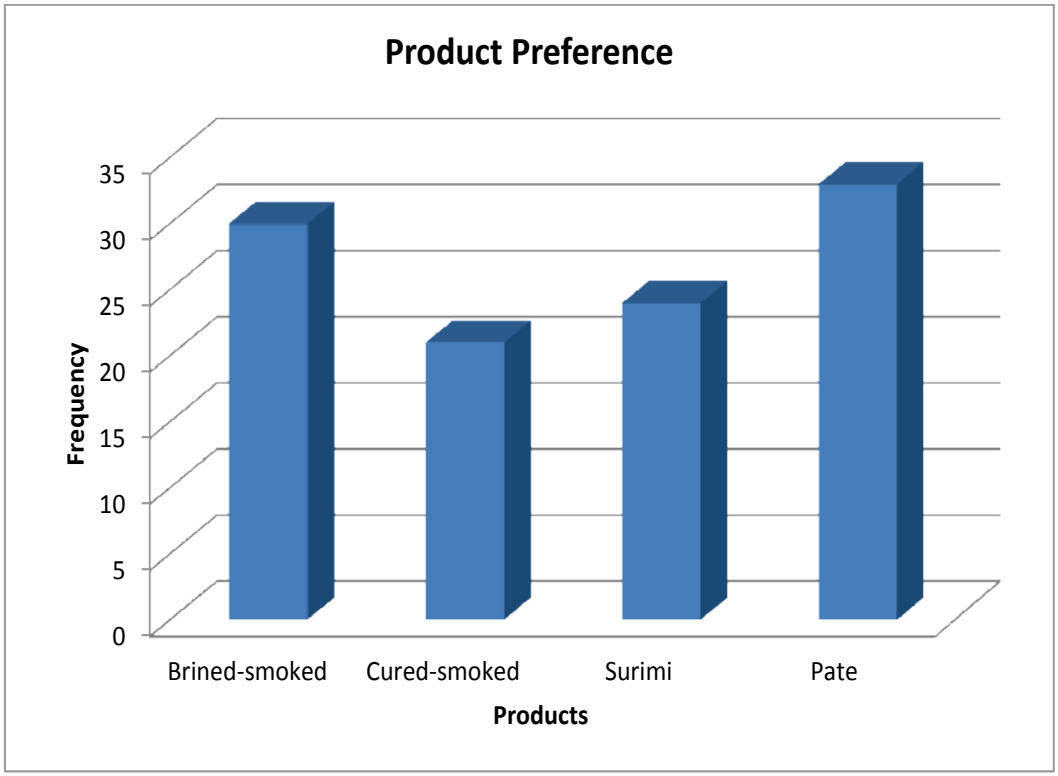

Figure 12: Ranking of the four tilapia products.

6.0 Discussion

Results of demographic data indicated that majority of the participants were male, in the age group of 21 to 40 years old, were of ethnic Samoan background with between 11 to 20 years of formal education and originally from Upolu Island where the capital Apia is located.

Fish (fresh, frozen and canned) are an important feature of the Samoan diet, and on average, households consumed fish at least once a week. This study revealed that more than a 50% of participants consumed fish at home, 8 times a month or twice a week while about 25% of participants consumed fish once a week or 4 times in a month. Tuna was the most commonly consumed species followed by parrotfish and Tilapia was the least consumed. However, although majority of the participants consumed Tuna, they agreed that the taste of Tilapia was the same as that of marine fish indicating their acceptance and preferred to buy live tilapia which may indicate their dislike for the value-added products. Results showed that freshness (compared to

appearance, taste and texture) was the most important attribute used when buying fish. When asked about attributes that contributed to a tasty tilapia, majority of respondents chose taste over texture and appearance.

The preference attributes for the individual tilapia products showed that odour was ranked the highest for brined-smoked; taste was ranked highest for cured-smoked; odour was most preferred for surimi and pate. The most preferred tilapia product was pate followed by brined-smoked, surimi and cured-smoked.

The data obtained in this study appeared to be in line with the study conducted by FAO in 1996 where Nile tilapia cooked in coconut cream without actually having reef fish for "on-the-spot" comparative tasting, showed that in the absence of reef fish, Nile tilapia was well accepted and on the same level as reef fish (Mulipola et al, 1997). Cooking fish in coconut cream is the most common traditional cooking method in Samoa and in the case of tilapia, the bland flavour may have been enhanced by the coconut cream.

In conclusion, the current study revealed that tilapia has potential in entering the Samoan commercial market. Participants generally accepted the alternative tilapia products for consumption and as a potential source of income. The sensory attributes of odour and taste were more popular amongst the Samoan participants compared to flavour, appearance and texture when ranking their preferences of the four tilapia products.

With regards to the level of importance of different attributes when choosing fish from a market, freshness was the most important followed by appearance, taste and flavour. Species was the least important.

Further research has to determine whether the tilapia farmers will be able to supply the market demand and cater for the potential commercial tilapia processing industry.

Acknowledgement

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7.0 References

Chapman, F.A. 2012. Culture of hybrid Tilapia: a reference profile. Fisheries and Aquatic Sciences Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.

Cortesi, M.L., Panebianco, A., Giuffrida, A. & Anastasio, A. 2009. Innovations in seafood preservation and storage. *Veterinary Research Communications*, 33(1):15:23.

FAO, 2012. State of the world fisheries and aquaculture 2010. FAO Fisheries and Aquaculture Department. Food and Agriculture Organization of the United Nations, Rome.

Fritzsimmons, K. 2006. Prospects and potential for global production, In: Lim, C. & Webster, C.D. (eds). Tilapia biology, culture and nutrition. New York: Haworth Press, pp.51-72.

Muir, J.F. & Roberts, R.J. (eds). 1988. Recent advances in aquaculture. Vol. 3 London: Croom Helm.

Mulipola, A., Bell, L., Skelton, P., Sisi, T., Matsunaga, Y. & Alefaio, F. 1997. Comparative taste study of Nile Tilapia (*Oreochromis niloticus*) and marine fish in Samoa and Nauru. South Pacific Aquaculture Development Project (PHASE II). Food and Agriculture Organization of the United Nations, Rome.

Nandlal, S. & Pickering, T. 2004. Tilapia fish farming in Pacific Island countries. Volume 1. Tilapia hatchery operation. Noumea, New Caledonia. Secretariat of the Pacific Community.

Appendix 1.

QUESTIONNAIRE

PARDI Nile Tilapia Consumer Acceptance Test

This questionnaire assesses consumer acceptance on the different preservation and value-added Tilapia products. Please follow the instruction carefully before completing the questionnaire.

SECTION A
Demographic characteristics

1. Sex: ☐ Male ☐ Female

2. Age_____

3. Ethnic background:
   - ☐ Samoa
   - ☐ European
   - ☐ Halfcast
   - ☐ Chinese
   - ☐ Other (Please specify) _____

4. Years of formal education _____

5. Which Island are you from?
   - ☐ Upolu
   - ☐ Savaii
   - ☐ Manono
   - ☐ Apolima
   - ☐ Other country (Please specify) _____

SECTION B
Consumption characteristics of fish consumers in general
This section is about your fish consumption characteristics. Please answer the questions below based on your consumption frequency and preference. You can tick more than 1 box wherever appropriate.

6. How often do you eat fish (on average)?
   - ☐ Once a month
   - ☐ 2-3 times per month
   - ☐ Once a week
   - ☐ ≥ 2 times a week
   - ☐ Seasonally
   - ☐ Other (Please specify) _____

7. Where do you often eat fish?

- ☐ Home
- ☐ Restaurant
- ☐ Both home and restaurant
- ☐ At a party or gathering
- ☐ Other (Please specify) _____

8. What types of fish species do you normally eat?

- ☐ Parrotfish (Fuga/Ulapo)
- ☐ Goatfish (Taulaia/Vete)
- ☐ Emperorfish (Mataeleele)
- ☐ Mullet
- ☐ Snapper
- ☐ Tuna
- ☐ Grouper
- ☐ Spinefoot
- ☐ Tilapia
- ☐ Other (Please specify) _____

9. Which of the following attributes do you consider important when choosing a fish in the market. *(Please tick and then rank the following attributes from 1 to 5)*

- ☐ Appearance _____
- ☐ Flavour _____
- ☐ Taste _____
- ☐ Cost _____
- ☐ Freshness _____
- ☐ Texture _____
- ☐ Size _____
- ☐ Species type _____
- ☐ Other (Please specify) _____

10. What is your perception of "Fresh farmed-raised (aquacultured) Nile Tilapia tastes" as equal to marine fish"

- ☐ Strongly agree
- ☐ Agree
- ☐ Neither agree nor disagree
- ☐ Disagree
- ☐ Other (Please specify) _____

11. Which of the following pre-treatment of Tilapia do you prefer to buy?

- ☐ Live
- ☐ Fresh untreated
- ☐ Frozen untreated

☐ Frozen-salted
☐ Fried-salted
☐ Smoked-salted
☐ Surimi
☐ Spread
☐ Other (Please specify) _____

12. What is your perception of a tasty Nile Tilapia (Cooked)

A tasty Nile Tilapia has to have the following attributes…..

Attributes		1	2	3	4	5	
Odour	Metallic						Earthy
Flavour	Metallic						Pungent
Taste	Fresh						Rancid
Appearance	Fresh						Dull
Texture	Firm						Soft
Size	Big						Small
With or without bone	Whole fish						Fillet
Comments							

SECTION C

Preference of Nile Tilapia products

Please rank the four Nile Tilapia products provided for you based on your preference by ticking the box of your rating from top (high) to bottom (low). Ranking is a 9 point scale in which "Like extremely" score is 9 as the highest and "Dislike extremely" score is 1 the lowest.

13. **Nile Tilapia product 1: Smoked 1**

Please rank the Nile Tilapia product 1 in front of you based on your preference attributes score from "Like extremely" to "Dislike extremely".

Rating scale	Odour	Flavour	Taste	Appearance	Texture	Size
Like extremely (9)						
Like very much (8)						
Like moderately (7)						
Like slightly (6)						
Neither like nor dislike (5)						
Dislike slightly (4)						
Dislike moderately (3)						
Dislike very much (2)						
Dislike extremely (1)						
Other comments						

14. **Nile Tilapia product 2: Smoked 2**

Please rank the Nile Tilapia product 1 in front of you based on your preference attributes score from "Like extremely" to "Dislike extremely".

Rating scale	Odour	Flavour	Taste	Appearance	Texture	Size
Like extremely						
Like very much						
Like moderately						
Like slightly						
Neither like nor dislike						
Dislike slightly						
Dislike moderately						
Dislike very much						
Dislike extremely						
Other comments						

15. **Nile Tilapia product 3: Surimi**

Please rank the Nile Tilapia product 1 in front of you based on your preference attributes score from “Like extremely” to “Dislike extremely”.

Rating scale	Odour	Flavour	Taste	Appearance	Texture
Like extremely					
Like very much					
Like moderately					
Like slightly					
Neither like nor dislike					
Dislike slightly					
Dislike moderately					
Dislike very much					
Dislike extremely					
Other comments					

16. **Nile Tilapia product 4: Pate**

Please rank the Nile Tilapia product 1 in front of you based on your preference attributes score from “Like extremely” to “Dislike extremely”.

Rating scale	Odour	Flavour	Taste	Appearance	Texture
Like extremely					
Like very much					
Like moderately					
Like slightly					
Neither like nor dislike					
Dislike slightly					
Dislike moderately					
Dislike very much					
Dislike extremely					
Other comments					

17. Taking all factors into considerations, which of the four types tasted do you prefer most?

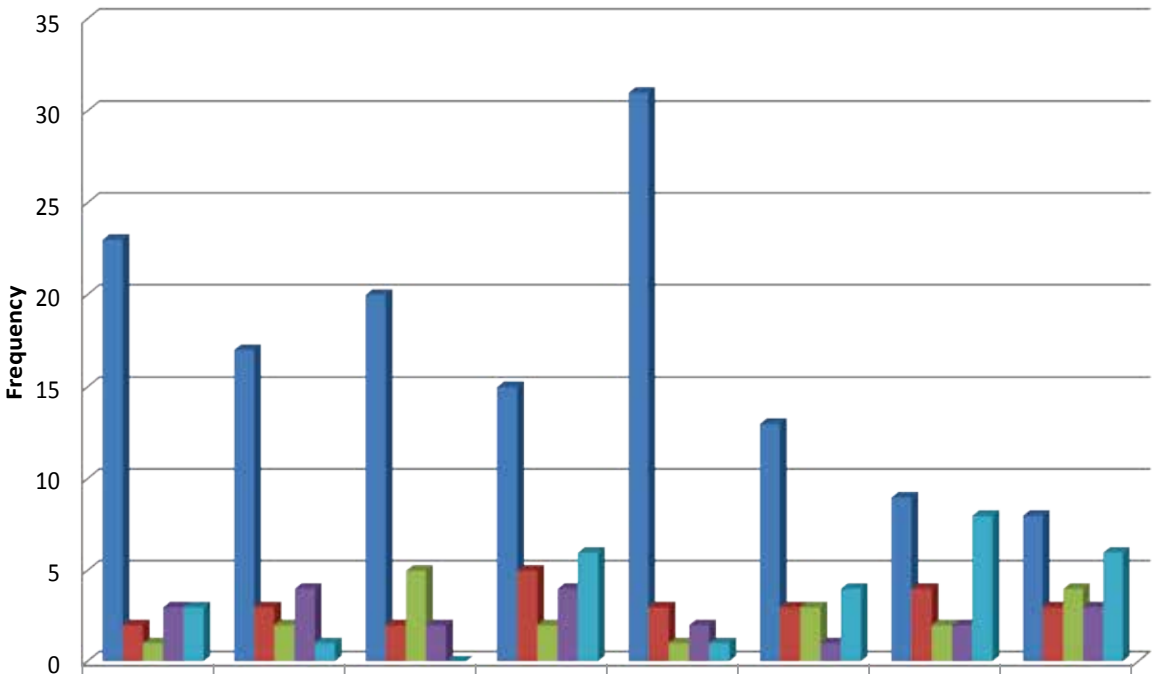
- ☐ Product 1: Smoked 1
- ☐ Product 2: Smoked 2
- ☐ Product 3: Surimi
- ☐ Product 4: Pate

18. Any other comments----------

Thank you very much for your participation in this sensory evaluation preference test!!!

Appendix 2.

Summary of the level of importance of different attributes when choosing fish from a market.



	Appearance	Flavour	Taste	Cost	Freshness	Texture	Size	Species
Most important (1)	23	17	20	15	31	13	9	8
Some importance (2)	2	3	2	5	3	3	4	3
Important (3)	1	2	5	2	1	3	2	4
A little important (4)	3	4	2	4	2	1	2	3
Least important (5)	3	1	0	6	1	4	8	6

Figure 13. Attribute ranking when buying fish.

Note: Participants only selected what they regarded as important.

Appendix 3.

Rating of level of importance of each attribute in contributing to a tasty tilapia.

Odour : very metallic odour regarded as the most important.

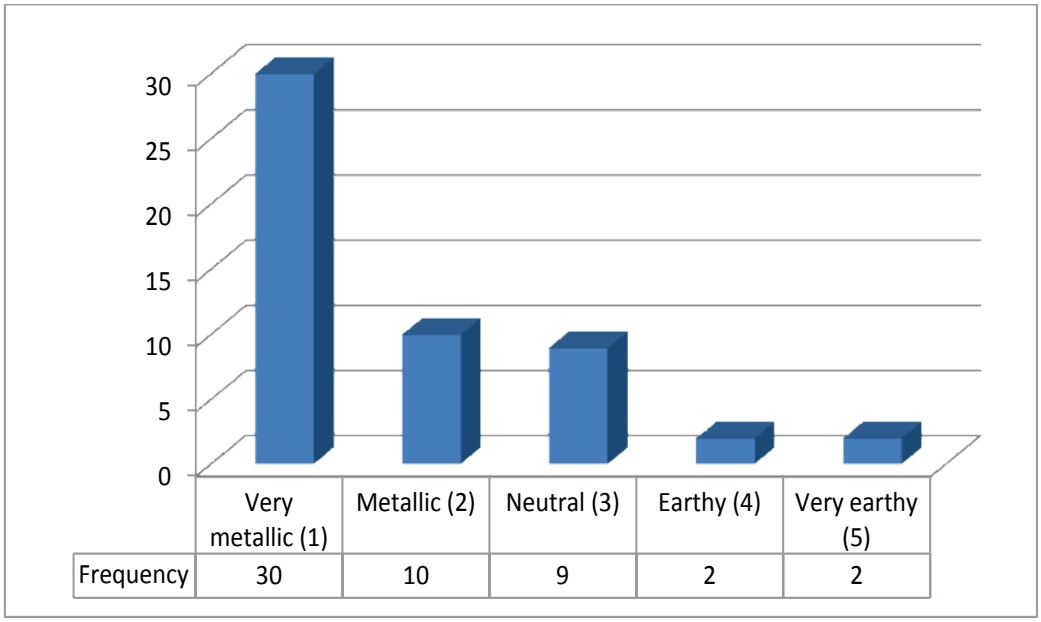


Figure 14: Rating the importance of 'odour' in contributing to a tasty tilapia.
*Participants only selected what they regarded as important

Flavour: very metallic flavour was regarded as the most important.

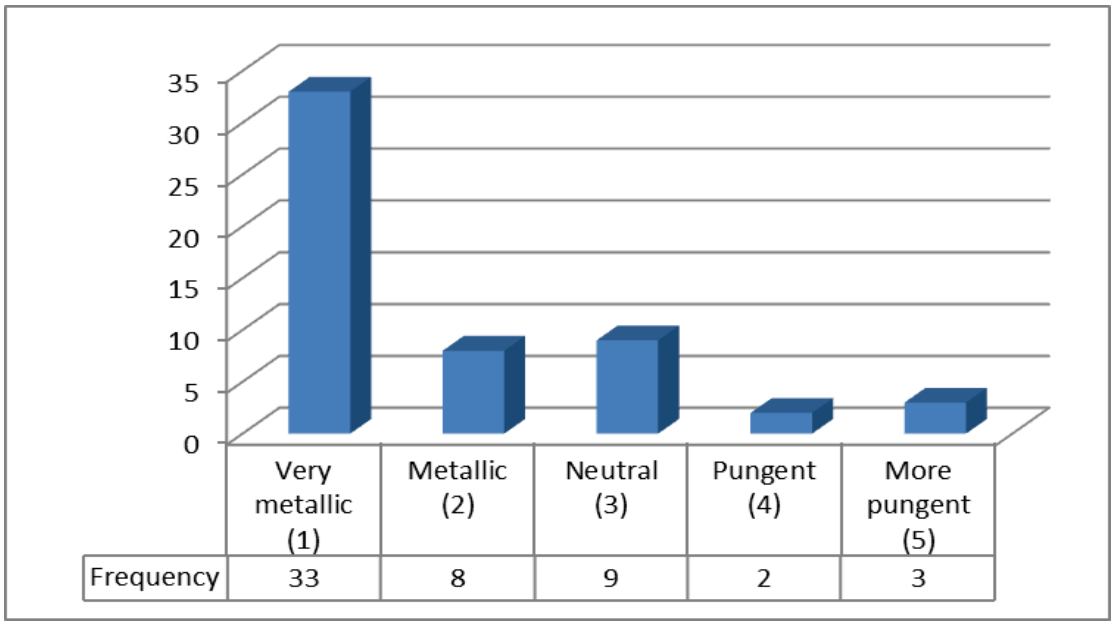


Figure 15: Rating in the importance of 'flavour' in contributing to a tasty tilapia.
*Participants only selected what they regarded as important.

Taste: Very fresh taste was regarded as the most important.

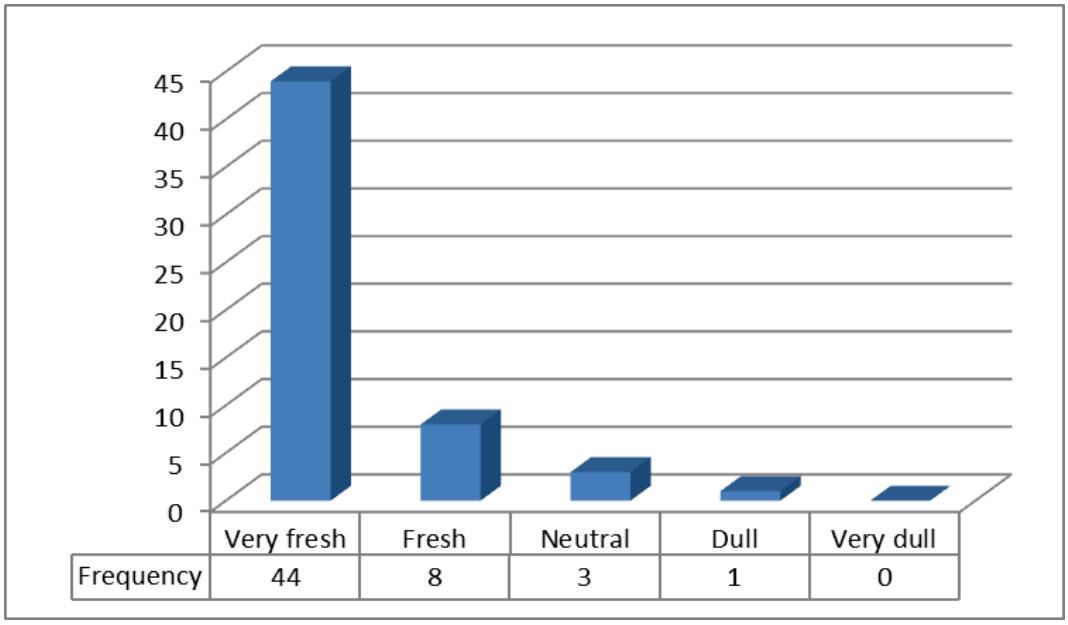


Figure 16: Rating the importance of 'taste' in contributing to a tasty tilapia.

Appearance: very fresh appearance was regarded as the most important.

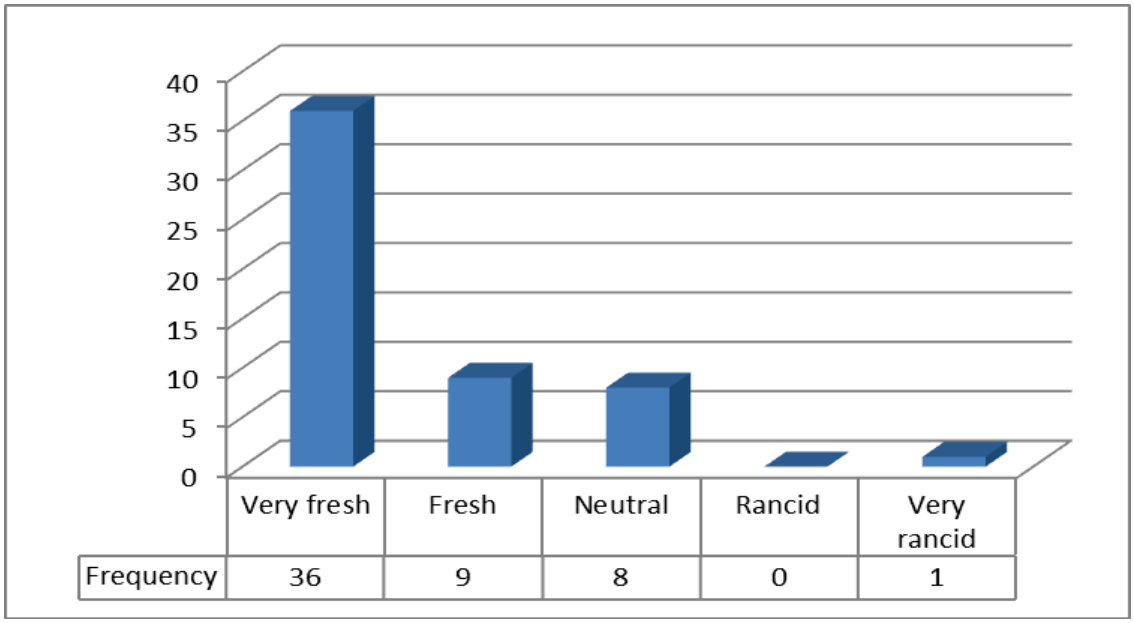


Figure 17: Rating the importance of 'appearance' in contributing to a tasty tilapia.

Texture: very firm texture was regarded the most important.

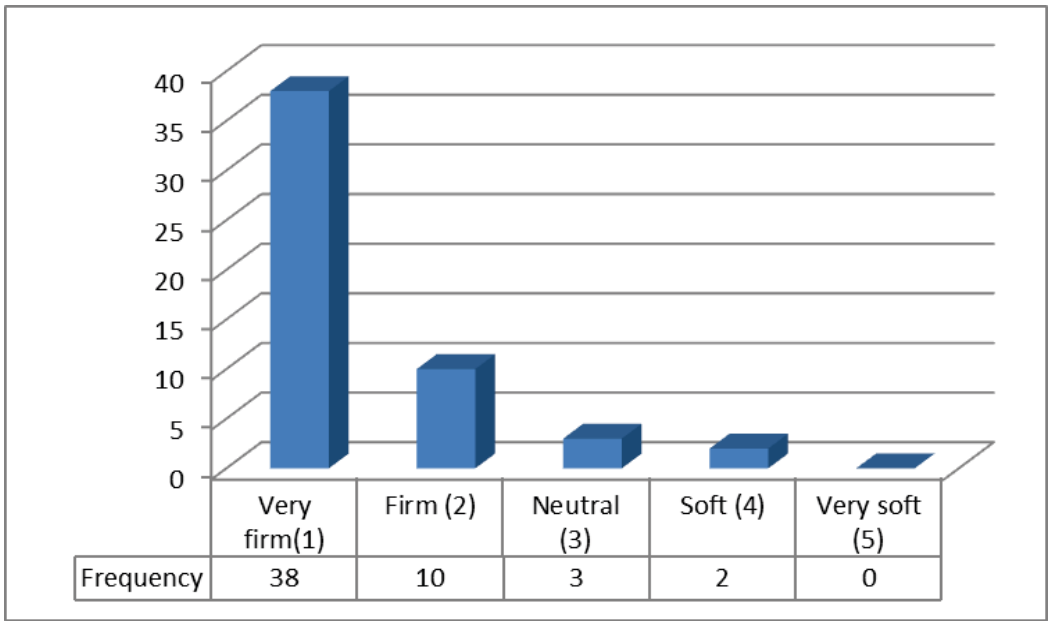


Figure 18: Rating the importance of 'texture' in contributing to a tasty tilapia.

Size: Bigger size is regarded most important.

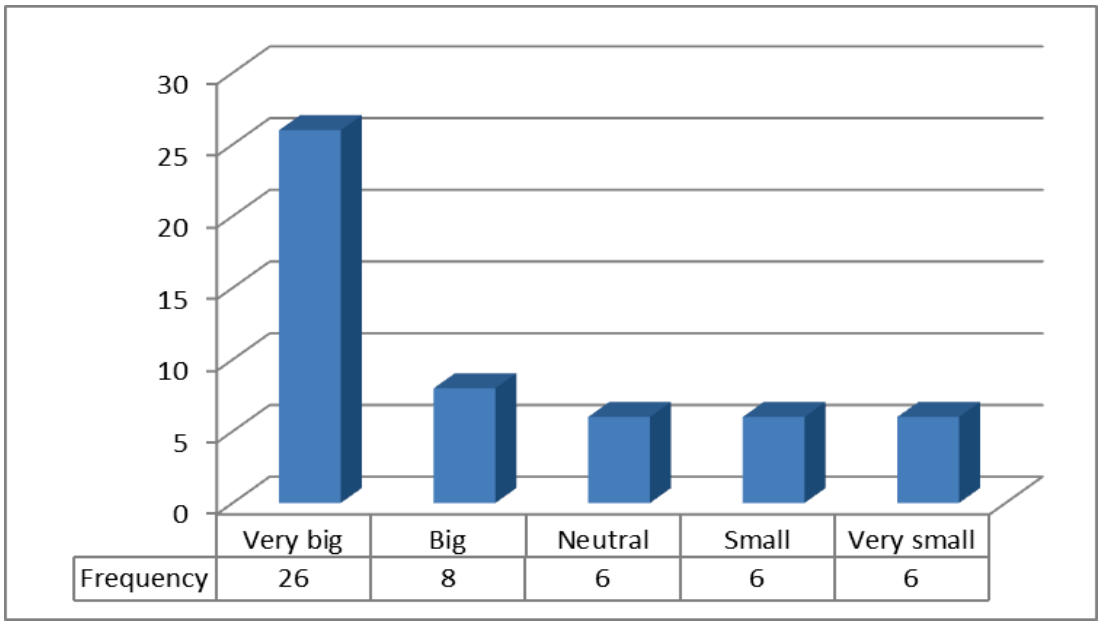


Figure 19: Rating in the importance of 'size' in contributing to a tasty tilapia.

Bones or fillet:

Majority of respondent's preferred whole fish compared to fillets when buying tilapia. This is expected as majority Pacific Islanders prefer to eat small whole fish. The 12 that preferred fillets were mainly Europeans and other ethnic groups.

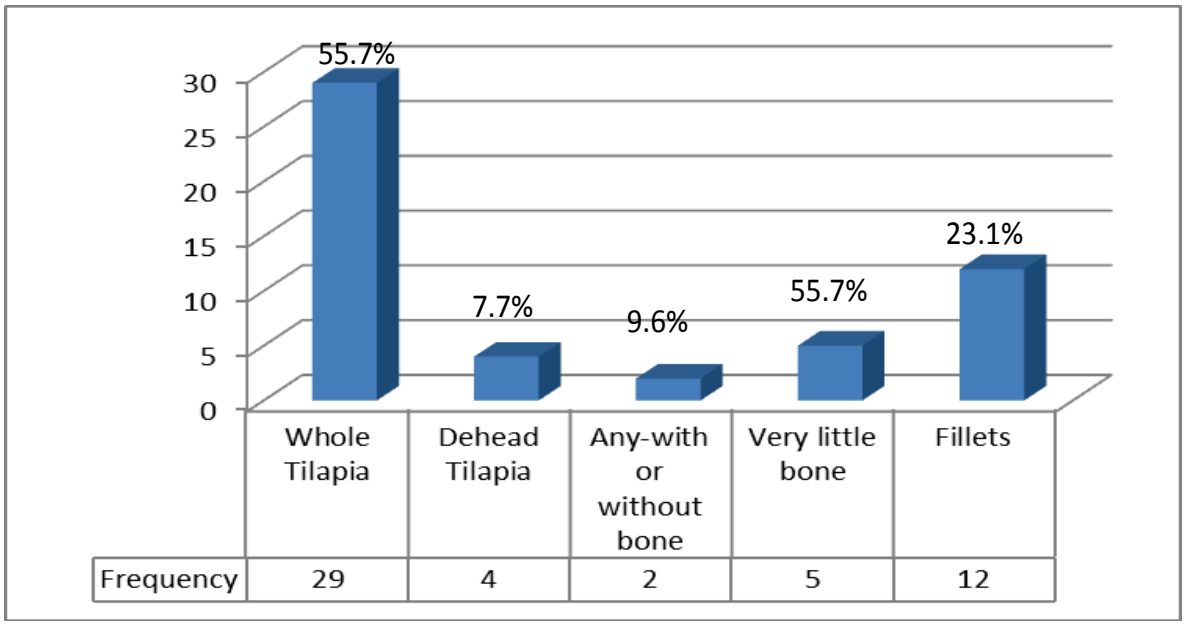


Figure 20: Rating the importance of 'bone or fillet' in contributing to a tasty tilapia.

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Much of IMR's work is externally-funded research and consultancies on the region's marine environment and its resources. Current activities centre on coral reef monitoring, marine biodiversity assessment, post-harvest fisheries, aquaculture management and cetacean research.

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